Prepared in cooperation with the cities of Alpharetta and Roswell, Georgia

Flood-Inundation Maps for Big Creek from the McGinnis Ferry Road Bridge to the Confluence of Hog Wallow Creek, Alpharetta and Roswell, Georgia

Pamphlet to accompany

Scientific Investigations Map 3338

U.S. Department of the Interior
U.S. Geological Survey

Cover. Left, Big Creek Greenway in Alpharetta, Georgia; right, Vickery Creek Trail in Roswell, Georgia (photographs by Jonathan W. Musser, U.S. Geological Survey).

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SALLY JEWELL, Secretary

U.S. Geological Survey
Suzette M. Kimball, Acting Director

U.S. Geological Survey, Reston, Virginia: 2015

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Sheets (Each sheet has individual pdf and jpg files available for downloading from http://dx.doi.org/10.3133/sim3338).

Conversion Factors

[Inch/Pound to International System of Units]

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square foot (ft^2)	0.09290	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

Datum

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Elevation, as used in this report, refers to distance above the vertical datum.

Stage, as used in this report, is the height of the water surface above an arbitrary datum established at the gage (gage datum).

Abbreviations

AHPS	Advanced Hydrologic Prediction Service
DFIRM	Digital Flood Insurance Rate Map
FEMA	Federal Emergency Management Agency
GIS	geographic information system
lidar	light detection and ranging
NWS	National Weather Service
USGS	U.S. Geological Survey

Acknowledgments

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Flood-Inundation Maps for Big Creek from the McGinnis Ferry Road Bridge to the Confluence of Hog Wallow Creek, Alpharetta and Roswell, Georgia

By Jonathan W. Musser

Abstract

Digital flood-inundation maps for a 12.4-mile reach of Big Creek that extends from 260 feet above the McGinnis Ferry Road bridge to the U.S. Geological Survey (USGS) streamgage at Big Creek below Hog Wallow Creek at Roswell, Georgia (02335757), were developed by the USGS in cooperation with the cities of Alpharetta and Roswell, Georgia. The inundation maps, which can be accessed through the USGS Flood Inundation Mapping Science Web site at http://water.usgs.gov/osw/flood_inundation/, depict estimates of the areal extent and depth of flooding corresponding to selected water levels (stages) at the USGS streamgage at Big Creek near Alpharetta, Georgia (02335700). Real-time stage information from this USGS streamgage may be obtained at http://waterdata.usgs.gov/ and can be used in conjunction with these maps to estimate near real-time areas of inundation. The National Weather Service (NWS) is incorporating results from this study into the Advanced Hydrologic Prediction Service (AHPS) flood-warning system (http://water.weather.gov/ahps/). The NWS forecasts flood hydrographs for many streams where the USGS operates streamgages and provides flow data. The forecasted peak-stage information for the USGS streamgage at Big Creek near Alpharetta (02335700), available through the AHPS Web site, may be used in conjunction with the maps developed for this study to show predicted areas of flood inundation.

A one-dimensional step-backwater model was developed using the U.S. Army Corps of Engineers HEC–RAS software for Big Creek and was used to compute flood profiles for a 12.4-mile reach of Big Creek. The model was calibrated using the most current (2015) stage-discharge relations at two USGS streamgages on Big Creek: Big Creek near Alpharetta (02335700) and Big Creek below Hog Wallow Creek at Roswell (02335757). The hydraulic model was then used to simulate 19 water-surface profiles at 0.5-foot intervals at the Big Creek near Alpharetta streamgage. The profiles ranged from just above bankfull stage (6.0 feet) to approximately 1.95 feet above the highest recorded water level at the Alpharetta streamgage site (15.0 feet). The simulated water-surface profiles were then combined with a geographic information system digital elevation model—derived from light detection and ranging data having a 3.0-foot horizontal resolution—to delineate the area flooded at each 0.5-foot interval of stream stage.

The availability of these maps, when combined with real-time stage information from USGS streamgages and forecasted stream stage from the NWS, provides emergency management personnel and residents with critical information during flood-response activities such as evacuations and road closures, in addition to post-flood recovery efforts.

Introduction

The cities of Alpharetta and Roswell, Georgia (Ga.), are suburban communities with estimated populations of 62,298 and 94,034, respectively, in 2013 (U.S. Census Bureau, 2015; fig. 1). Development on the Big Creek flood plain within the cities is varied with a mix of residential, recreational, and commercial structures; and areas of grass fields, wetlands, and forest (Homer and others, 2015). Big Creek flows generally southwest through Alpharetta and Roswell, Ga., which are located in the northern part of Fulton County, Ga. (fig. 1). Peak flood flows in excess of 5,000 cubic feet per second (ft^3/s) were recorded at the Alpharetta streamgage site in the years 1961, 1977, 1982, 1990, and 2009; the largest peak flood flow was recorded on February 3, 1982, at 6,100 ft^3/s.

Before this study, city of Alpharetta and Roswell officials relied on several information sources (available on the Internet) to make decisions on how best to alert the public and mitigate flood damages along Big Creek. One source of information was the Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) (Federal Emergency Management Agency, 2014). A second source of information was the U.S. Geological Survey (USGS) streamgages (table 1) Big Creek near Alpharetta

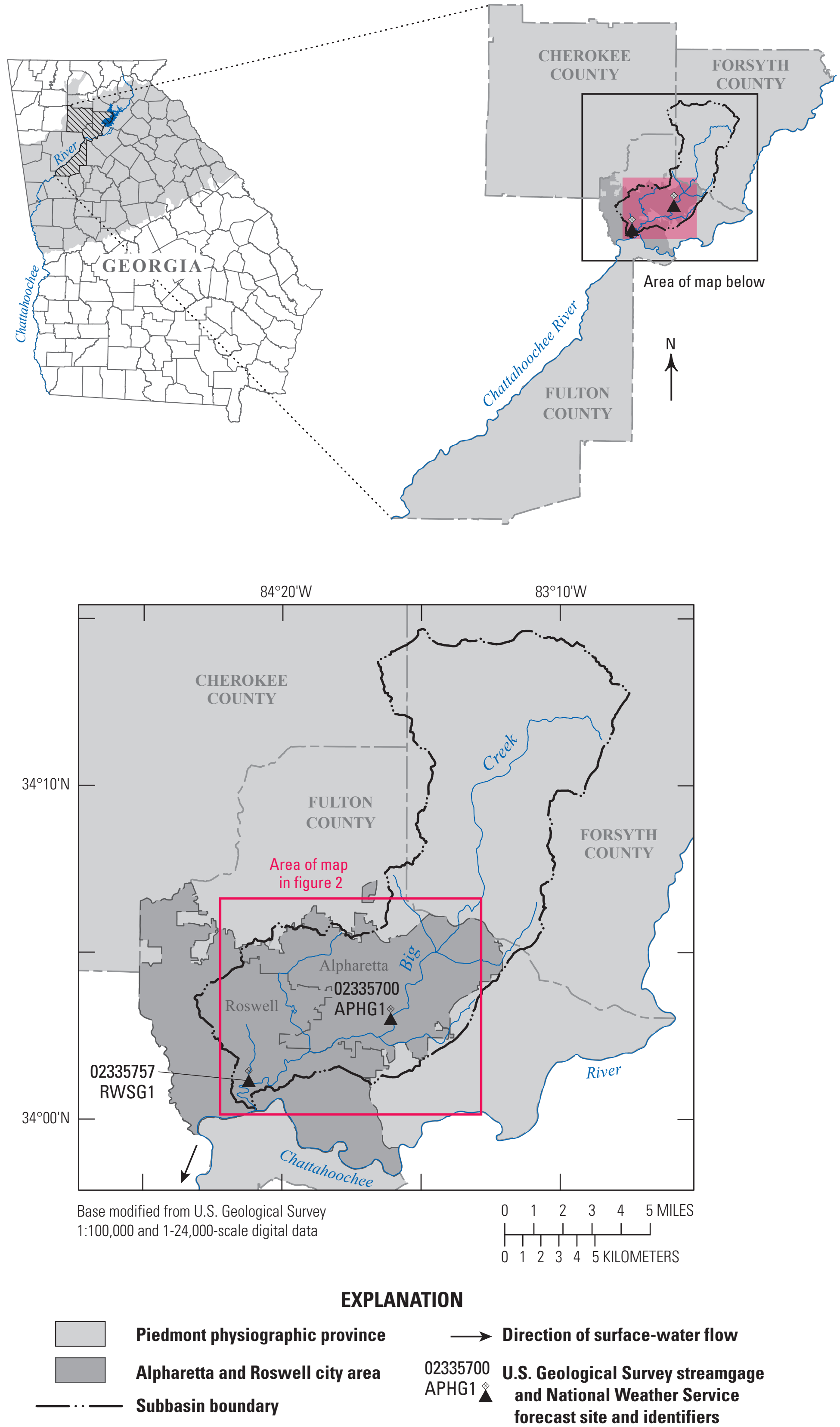

Figure 1. The study reach for Big Creek, U.S. Geological Survey (USGS) streamgages, and National Weather Service (NWS) forecast sites.

Table 1. Site information for the U.S. Geological Survey streamgages in the Big Creek basin at Alpharetta and Roswell, Georgia.

[See figure 1 for station location. USGS, U.S. Geological Survey; Ga., Georgia; ft, feet; current year, year of publication]

Station name	USGS station number	Drainage area (square miles)	Latitude	Longitude	Period of record	Maximum recorded stage at gage and date
			(degrees, minutes, seconds)			
Big Creek near Alpharetta, Ga.	02335700	72.0	34°03'02"	84°16'10"	1960 to current year	13.05 ft Feb. 3, 1982
Big Creek below Hog Wallow Creek at Roswell, Ga.	02335757	103	34°01'02"	84°21'12"	2004 to current year	15.24 ft Sept. 22, 2009

(02335700) and Big Creek below Hog Wallow Creek at Roswell (02335757) from which current or historical water levels (stage) can be obtained (through the USGS Web site, http://waterdata.usgs.gov/nwis/). Stage is the height of the water surface above an arbitrary datum established at the gage (gage datum). A third source of information used by city officials was the National Weather Service (NWS) forecast of peak stages at the USGS Big Creek near Alpharetta streamgage (forecast site APHG1) and the USGS Big Creek at Roswell streamgage (forecast site RWSG1) through the Advanced Hydrologic Prediction Service (AHPS) Web site at http://water.weather.gov/ahps/.

Although USGS real-time stage data and NWS forecast stages are particularly useful for residents in the immediate vicinity of a streamgage, the data are of limited use to residents farther upstream or downstream because the water-surface elevation is not constant everywhere along an entire stream channel. Likewise, depth varies locally along stream channels, and FEMA and State emergency management mitigation teams or property owners typically lack information related to water depth in areas that are not near USGS streamgages or NWS flood-forecast points. To help guide the general public in taking individual safety precautions and provide local officials with a tool to help efficiently manage emergency flood operations and flood-mitigation efforts, a series of digital flood-inundation maps for a 12.4-mile (mi) reach of Big Creek were developed by the USGS in cooperation with the cities of Alpharetta and Roswell, Ga.

Purpose and Scope

The purpose of this report is to describe the development of a series of estimated flood-inundation maps for Big Creek in Alpharetta and Roswell, Ga. The maps and other flood information are available on the USGS Flood Inundation Mapping Science Web site at http://water.usgs.gov/osw/flood_inundation/ and the previously mentioned NWS AHPS Web site. Internet users can select estimated inundation maps that would be close to (1) current stage at the USGS streamgage near Alpharetta (02335700), (2) the NWS forecasted peak stage, or (3) other desired stages at the USGS streamgage on Big Creek near Alpharetta (02335700).

The scope of the study was limited to a 12.4-mi reach of Big Creek that extends from about 260 feet (ft) above the McGinnis Ferry Road bridge to about 30 ft downstream of the confluence of Big Creek and Hog Wallow Creek, which is also referred to as Hog “Waller” Creek (fig. 2). Tasks specific to development of the flood-inundation maps were (1) analysis of the flow and stage data collected at two USGS streamgages: Big Creek near Alpharetta (02335700) and Big Creek below Hog Wallow Creek at Roswell (02335757) (table 1); (2) collection of topographic data and geometric data (for flood plains, flow-control structures, bridges, and the stream channel) throughout the study reach; (3) determination of energy-loss factors (roughness coefficients) in the stream channel and flood plain; (4) computation of water-surface profiles using the U.S. Army Corps of Engineers HEC–RAS computer program (U.S. Army Corps of Engineers, Hydrologic Engineering Center, 2010); (5) production of estimated flood-inundation maps based on simulated stream stages at the Big Creek near Alpharetta streamgage using the U.S. Army Corps of Engineers HEC–GeoRAS computer program (U.S. Army Corps of Engineers, Hydrologic Engineering Center, 2014) and a geographic information system (GIS); and (6) development of a Web site interface that links to USGS real-time streamgage information, NWS forecasted peak stage, or both to facilitate the display of user-selected flood-inundation maps on the Internet.

Methods

Methods used generally are cited from previously published reports (Bales and others, 2007; Whitehead and Ostheimer, 2009). If techniques varied substantially from previously documented methods because of local hydrologic conditions or available data, they are described in detail in this report. Inundation maps were produced for 19 water-surface profiles referenced to the stage at the streamgage Big Creek near Alpharetta (02335700). These profiles ranged from about bankfull stage (6.0 ft) to 1.95 ft above the maximum water level recorded at the streamgage (15.0 ft).

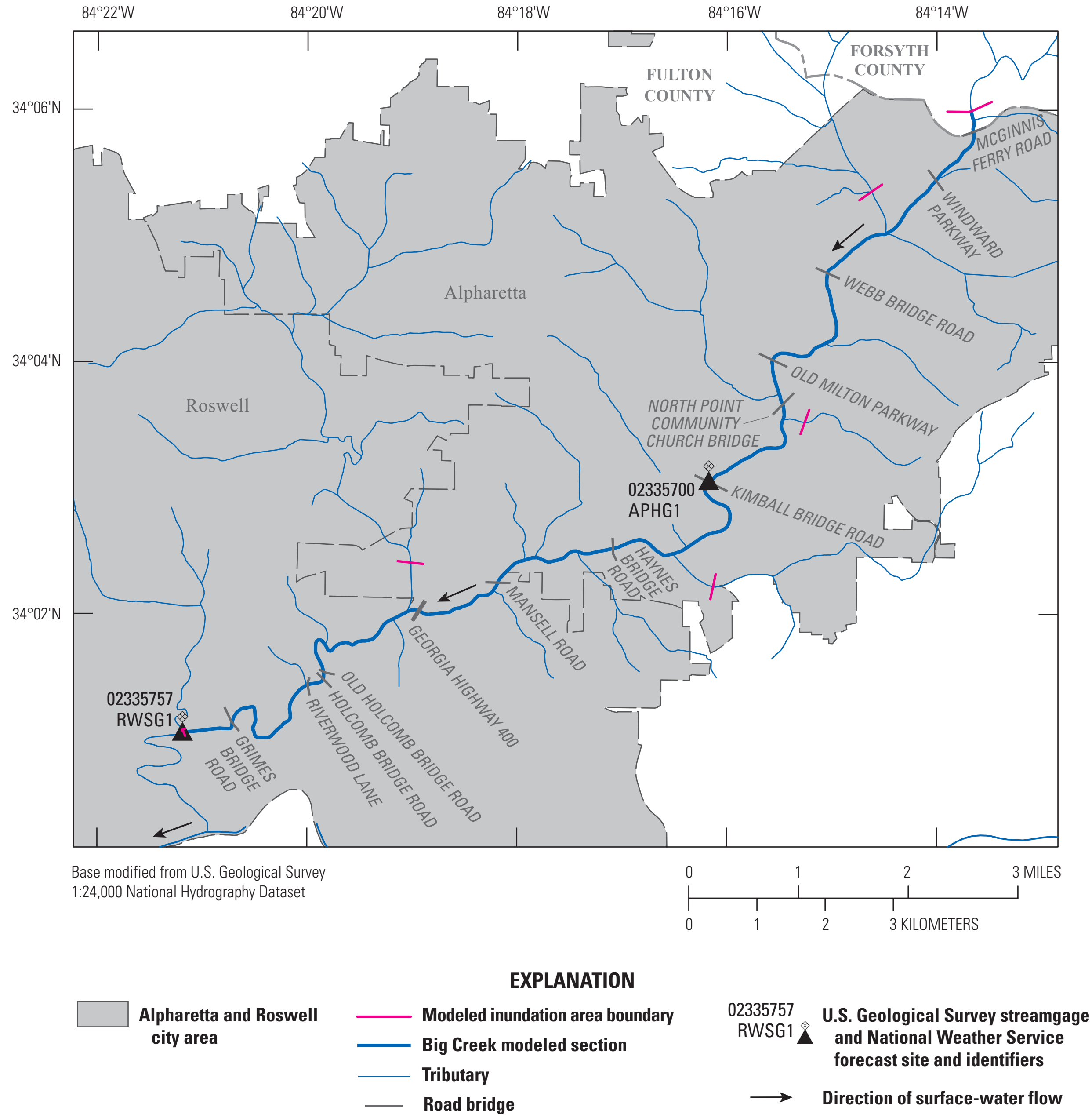

Figure 2. Big Creek bridge crossings, model extent, direction of surface-water flow, U.S. Geological Survey (USGS) streamgages, and National Weather Service (NWS) forecast sites.

Study Area Description

Big Creek is in northern Georgia in the Piedmont physiographic province (Clark and Zisa, 1976). The drainage area ranges from 52.7 square miles (mi^2) at the upstream end of the study reach about 260 ft upstream from the McGinnis Ferry Road bridge to 72.0 mi^2 at the Big Creek near Alpharetta streamgage (02335700) to 103 mi^2 at the Big Creek below Hog Wallow Creek at Roswell streamgage (02335757), which is at the downstream end of the study reach (fig. 2). The headwaters of Big Creek originate in Forsyth and Cherokee Counties, Ga. (fig. 1). Big Creek and its tributaries generally flow southward through Forsyth and Fulton Counties, Ga., until emptying into the Chattahoochee River. Within Fulton County, Ga., the tributaries flowing into Big Creek are Caney Creek, Camp Creek, Long Indian Creek, Foe Killer Creek, and Hog Wallow Creek. The Big Creek basin terrain is gently rolling with stream valleys that are fairly deep and narrow and lie 100 to 200 ft below the narrow, rounded stream divides (Clark and Zisa, 1976). The study reach is about 12.4 mi long, is fairly consistent with some local variations, and has an average channel slope of about 5.2 feet per mile (ft/mi). The land that is contiguous to the study reach is mostly classified as developed, but some areas are classified as forest. Some large areas of woody wetlands are along Big Creek and its tributaries (Fry and others, 2011). The main channel within the study reach has 13 primary road bridges, as well as 6 foot and golf cart bridges that cross the channel and adjacent flood plain.

Previous Studies

The current DFIRM for Fulton County, Ga., was published on September 18, 2013 (Federal Emergency Management Agency, 2014). The DFIRM was used to check the inundation extent for stages that are close to the 1-percent and 0.2-percent annual exceedance probability. HEC–RAS models of Big Creek, which were used in the publication of the DFIRM, were obtained in 2014 from Sam Fleming at Dewberry, an engineering firm contracted by FEMA to model specific flood stages on Big Creek. The cross sections, stream channel, and bridge details within the study reach were taken from the existing HEC–RAS models and used as a starting point for creation of the model developed for this study.

Similar studies that provide flood-inundation maps for a range of stream stages were completed by the USGS in Albany, Ga., for the Flint River (Musser and Dyar, 2007); in Atlanta, Ga., for Peachtree Creek (Musser, 2012a); in Gwinnett County, Ga., for Suwanee Creek (Musser, 2012b); and in Cobb County, Ga., for Sweetwater Creek (Musser, 2012c). The methods for the Flint River model used a finite-element two-dimensional model, which differed from those used to develop the Big Creek model. The methods used for the Peachtree Creek, Suwanee Creek, and Sweetwater Creek models were similar to those used to develop the Big Creek model.

Constructing Water-Surface Profiles

The water-surface profiles used to produce the 19 flood-inundation maps developed for this study were computed using HEC–RAS, version 4.1.0 (U.S. Army Corps of Engineers, Hydrologic Engineering Center, 2010). HEC–RAS is a one-dimensional step-backwater model for simulation of water-surface profiles with gradually varied, steady-state or unsteady-state flow computation options. For this study, the HEC–RAS analysis was completed by using the steady-state flow computation option.

Hydrologic and Steady-Flow Data

The hydrologic network in the study area consists of two USGS streamgages that are operated within the study reach (fig. 1; table 1). Water level (stage) is measured continuously at each site, and continuous records of streamflow are computed. Stage is the height of the water surface above an arbitrary datum established at the gage (gage datum). All water-surface elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88). The streamgages are equipped with a satellite radio transmitter that allows data to be transmitted routinely and made available on the Internet within an hour of collection. The streamgage on Big Creek near Alpharetta (02335700) is also equipped with a recording rain gage. Steady-flow data consisted of flow regime, boundary conditions (stage and discharge values), and peak discharge information. Steady-flow data for the study reach were calibrated in the model using the stage-discharge relation at the Big Creek near Alpharetta streamgage (02335700). Downstream boundary conditions in the model were determined using the stage-discharge relation at the Big Creek below Hog Wallow Creek at Roswell streamgage (02335757).

Topographic/Bathymetric Data

The cross sections from the existing HEC–RAS DFIRM model of Big Creek, obtained from Dewberry, were used as a starting point for the model developed in this study. Hereafter, "DFIRM" will be used to describe the previous version of the model as obtained from Dewberry (Sam Fleming, written commun., August, 2014). Additional cross sections were added to the USGS model where the distance between two cross sections was more than 500 ft in the DFIRM model. The in-channel elevations of these new cross sections were calculated by extracting the in-channel part of an original cross section and lowering or raising it based on the channel slope between two adjacent original cross sections. The overbank elevations of the new cross sections were calculated from a raster elevation dataset. The source for the raster elevation was a 3.0-ft by 3.0-ft cell raster from light detection and ranging (lidar) data obtained from the Atlanta Regional Commission. The estimated height accuracy of the lidar data is plus or minus (±) 0.12 meter. The flow lengths between cross sections were recomputed after the new cross sections were added to the model. Additionally, all ineffective flow areas were reevaluated and recalculated for all cross sections.

Various drainage structures (bridges, culverts, roadway embankments, levees, and dams) in and along the stream affect or have the potential to affect water-surface elevations during floods. To properly account for these features in the model, structural dimensions for 12 bridges were measured and surveyed in the field. The geometry of these bridge structures was already present in the existing DFIRM HEC–RAS model. The bridge over Big Creek on Kimball Bridge Road was rebuilt after the DFIRM model was created. The old bridge geometry was removed from the updated model, and the new bridge geometry was added. A new bridge over Big Creek at North Point Community Church was also built after the DFIRM model was completed. A site inspection of the bridge was completed to determine if it should be added to the model. The bridge has no embankments that encroach upon the flood plain and is high enough that the highest flows simulated by the model will not reach the bottom of the bridge structure. The bridge has five piers that are 3.5 ft wide and one that is 5 ft wide over about an 840 ft length. Any flow disruption from these small piers would be offset by the lack of trees and vegetation below the bridge. The effects of the bridge on modeled flood flow in Big Creek are assumed to be negligible, and the bridge was not added to the model. One of the six small foot bridges in the study reach caused instability when the model was being developed. The effects of this bridge are also assumed to be negligible because of its small size. The bridge is about 50 ft long, 12 ft wide, has open guard rails and decking supports that allow flow through, and is at bank level. There are no piers in the stream channel. As a result, the geometry of this foot bridge was removed from the existing model in order to eliminate the instability.

Site visits were made to all bridges to confirm the accuracy of the bridge geometry in the existing DFIRM model. A total of 19 different bridges are located within the modeled reach. From upstream to downstream, the bridges are McGinnis Ferry Road, a golf cart bridge, Windward Parkway, a golf cart bridge, a golf cart bridge, Webb Bridge Road, Old Milton Parkway, North Point Community Church bridge (not included in the model), Kimball Bridge Road, a foot bridge, a foot bridge, Haynes Bridge Road, a foot bridge (removed from the model), Mansell Road, Georgia Highway 400, Old Holcomb Bridge Road, Holcomb Bridge Road, Riverwood Lane, and Grimes Bridge Road (fig. 2).

A detailed description of the methods used to acquire and process the topographic and bathymetric data is provided in Bales and others (2007).

Energy Loss Factors

Field observations and high-resolution aerial photographs were used to select initial (precalibration) Manning's roughness coefficients ("*n*" values) for energy (friction) loss calculations. The final Manning's *n* values ranged from 0.019 to 0.05 for the main channel. The Manning's *n* values ranged from 0.06 (light vegetation areas) to 0.14 (forested areas with heavy undergrowth) for the overbank areas modeled in the reach.

Model Calibration and Performance

The hydraulic model was calibrated using the most current (2015) stage-discharge relation (http://waterdata.usgs.gov/nwis/) at the Big Creek near Alpharetta streamgage (02335700). This streamgage has been in operation since 1960, and the maximum peak discharge was recorded at the site on February 3, 1982. The peak discharge recorded was 6,100 ft^3/s at a stage of 13.05 ft. The flow values for the stages from 13.5 ft to 15.0 ft were obtained using a straight line extension of the rating curve above 13.05 ft.

The only high-water mark available was reported by city of Alpharetta personnel as about 3 inches of water on top of the bridge crossing Webb Bridge Road in September 2009 when Big Creek was at a stage of 12.50 feet and a discharge of 5,200 ft^3/s. At the stage of 12.5 ft at the Alpharetta streamgage, the calibrated model developed for this study simulated a water-surface elevation of 987.41 ft at the Webb Bridge Road bridge, and the elevation of the top of the bridge deck is 987.60 ft; therefore, the simulated water-surface elevations produced by the updated model seem to be consistent with the observations made during the flood event in September 2009.

The model was calibrated by adjusting Manning's *n* value of the channel and overbanks until the results of the hydraulic computations closely agreed with the known stage-discharge relation at the Alpharetta streamgage. The calibration was for each 0.5-ft stage interval so that the Manning's *n* values change for the different stages. Differences between measured and simulated water levels for models calibrated to stages were between minus (–) 0.1 and plus (+) 0.1 ft (table 2). The boundaries of the DFIRM flood zones were similar to the boundaries of the modeled inundated areas for the 14-ft Big Creek stage in the USGS inundation model. Details on techniques used in model development and calibration are provided in Bales and others (2007).

Table 2. Comparison of hydraulic-model output and water-surface elevation at the Big Creek near Alpharetta, Georgia, streamgage (02335700).

[Values listed in feet above North American Vertical Datum of 1988]

Stage	Actual water-surface elevation	Modeled water-surface elevation	Elevation difference
6.0	966.6	966.7	+0.1
6.5	967.1	967.1	0.0
7.0	967.6	967.6	0.0
7.5	968.1	968.2	+0.1
8.0	968.6	968.5	−0.1
8.5	969.1	969.1	0.0
9.0	969.6	969.6	0.0
9.5	970.1	970.1	0.0
10.0	970.6	970.6	0.0
10.5	971.1	971.1	0.0
11.0	971.6	971.6	0.0
11.5	972.1	972.1	0.0
12.0	972.6	972.6	0.0
12.5	973.1	973.0	−0.1
13.0	973.6	973.7	+0.1
13.5	974.1	974.1	0.0
14.0	974.6	974.7	+0.1
14.5	975.1	975.1	0.0
15.0	975.6	975.6	0.0

Development of Water-Surface Profiles

Profiles were developed for 19 stages at 0.5-ft intervals between 6.0 and 15.0 ft as referenced to the Big Creek near Alpharetta streamgage (02335700). Discharges corresponding to profiles at stages were obtained from the most current (2015) stage-discharge relation in use at the Alpharetta streamgage (rating no. 25.0, effective October 6, 2001). These discharge values were used as input in the model. The discharges for all profiles were adjusted along Big Creek primarily at junctions with smaller tributaries. These discharge values were calculated based on a ratio of streamflow to drainage area raised to the 0.57 power (Gotvald and Knaak, 2011). Upstream from the Alpharetta streamgage, the discharge values were smaller than at the streamgage, and downstream they were larger.

Simulated stage and discharge estimates for selected locations and profiles are shown in table 3. The water-surface elevation used for the downstream boundary condition was based on the Big Creek below Hog Wallow Creek at Roswell streamgage (02335757) most current (2015) stage-discharge relation (rating no. 4.1, effective October 1, 2008). The estimated discharges at the Roswell streamgage from the streamflow to drainage area raised to the 0.57 power were used with the stage-discharge relation to determine the corresponding gage heights for each estimated discharge, which were then used as the water-surface elevation for the downstream boundary condition.

Because of the lack of high streamflow records at the Roswell streamgage, the stage-discharge relation does not extend to the higher estimated flows, which were computed with the streamflow to drainage area raised to the 0.57 power. The highest downstream boundary condition streamgage height able to be computed from this method was a streamgage height of 15.34 ft at the Roswell streamgage and 12.5 ft at the Alpharetta streamgage. A normal depth based on slope of the streambed method was used for the downstream boundary conditions for the water-surface elevations of 13.0 to 15.0 ft at the Alpharetta streamgage (U.S. Army Corps of Engineers, Hydrologic Engineering Center, 2010). The streambed slope value was determined, which resulted in a water-surface elevation that was the same as the water-surface elevation from the 15.34-ft streamgage height at Roswell for the streamflows based on the 12.5-ft streamgage height at Alpharetta. This normal depth downstream boundary condition based on the streambed slope was used for the model for the 13.0- to 15.0-ft streamgage height at Alpharetta. All streamflow and water elevation data used for the model are available in the USGS National Water Information System available at http://waterdata.usgs.gov/nwis/.

Inundation Mapping

Flood-inundation maps were created based on simulated water-surface elevations at the Big Creek near Alpharetta streamgage (02335700), which has been designated as a NWS flood-forecast point (APHG1). The maps were created in a GIS by combining the water-surface profiles and digital elevation model data. The digital elevation model data are from a 3.0-ft by 3.0-ft cell raster derived from lidar data obtained from the Atlanta Regional Commission. Estimated flood-inundation boundaries for each simulated profile were developed with HEC–GeoRAS software (U.S. Army Corps of Engineers, Hydrologic Engineering Center, 2014). HEC–GeoRAS is a set of procedures, tools, and utilities for processing geospatial data in ArcGIS (Esri, 2015) by using a graphical user interface (Whitehead and Ostheimer, 2009). The interface allows the preparation of geometric data for import into HEC–RAS and processes simulation results exported from HEC–RAS (U.S. Army Corps of Engineers, Hydrologic Engineering Center, 2010). HEC–GeoRAS results were modified to ensure a hydraulically reasonable transition of the boundary between modeled cross sections relative to the contour data for the land surface (Whitehead and Ostheimer, 2009). The resulting inundation maps have a vertical accuracy of about 0.5 ft. The maps show estimated flood-inundated areas overlain on high-resolution, georeferenced, aerial photographs of the study area for each of the water-surface profiles that were generated by the hydraulic model. The sheet numbers corresponding to each 0.5-ft stage increment at the Big Creek streamgage are shown in table 4.

Big Creek, Georgia, Flood-Inundation Maps on the Internet

A USGS Flood Inundation Mapping Science World Wide Web portal (http://water.usgs.gov/osw/flood_inundation/) has been established to provide estimated flood-inundation information to the public. The maps from this study are available in several commonly used electronic file formats that can be downloaded from that portal. Each stream reach displayed on the Web site contains links to the USGS National Water Information System graphs of the current stage and streamflow at the USGS Big Creek near Alpharetta streamgage (02335700) to which the inundation maps are referenced. A link also is provided to the NWS AHPS Web site (http:/water.weather.gov/ahps/) so that the user can obtain applicable information on forecasted peak stage. The estimated flood-inundation maps are displayed in sufficient detail to note the extent of flooding with respect to individual structures so that preparations for flooding and decisions for emergency response can be performed efficiently.

Disclaimer for Flood-Inundation Maps

Inundated areas shown should not be used for navigation, regulatory, permitting, or other legal purposes. The USGS provides these maps “as-is” for a quick reference, emergency planning tool but assumes no legal liability or responsibility resulting from the use of this information.

Uncertainties and Limitations Regarding Use of Flood-Inundation Maps

The flood boundaries shown were estimated based on water stages/streamflows at the USGS streamflow gaging station, Big Creek near Alpharetta (02335700), steady-state hydraulic modeling (assuming unobstructed flow) and a digital elevation model. The hydraulic model reflects the land-cover characteristics and any bridge, dam, levee, or other hydraulic structures existing in May 2015. Unique meteorological factors (timing and distribution of storm) could cause actual streamflows along the modeled reach to vary from those assumed during a flood, which may lead to deviations from the water-surface elevations and inundation boundaries shown here. Additional areas may be flooded due to unanticipated backwater from major tributaries along the main stem or from localized debris- or ice-jams. Inundated areas shown should not be used for navigation, regulatory, permitting, or other legal purposes. Although the USGS intends to make this server available 24 hours a day, 7 days a week, timely delivery of data and products from this server through the Internet is not guaranteed. The USGS provides these maps “as-is” for a quick reference, emergency planning tool, but assumes no legal liability or responsibility resulting from the use of this information.

If this series of flood-inundation maps will be used in conjunction with National Weather Service (NWS) river forecasts, the user should be aware of additional uncertainties that may be inherent or factored into NWS forecast procedures. The NWS uses river forecast models to estimate the quantity and timing of water flowing through selected river reaches in the United States. These forecast models (1) estimate the amount of runoff generated by a precipitation event, (2) compute how the water will move downstream, and (3) predict the flow and stage (water-surface elevation) for the river at a given location (Advanced Hydrologic Prediction Service [AHPS] forecast point) throughout the forecast period (every 6 hours and 3 to 5 days out in many locations). For information on AHPS forecasts, please see http://water.weather.gov/ahps/pcpn_and_river_forecasting.pdf.

Table 3. Stages (and water-surface elevations) with corresponding discharge estimates for selected simulated water-surface profiles at selected locations for the Big Creek near Alpharetta, Georgia, streamgage (02335700); and for the downstream boundary condition at Big Creek below Hog Waller Creek at Roswell, Georgia, streamgage (02335757).

[NAVD 88, North American Vertical Datum of 1988]

Location of discharge estimate for Big Creek	Stage, in feet above the gage datum (Water-surface elevation, in feet above NAVD 88)									
	6.0 (966.6)	7.0 (967.6)	8.0 (968.6)	9.0 (969.6)	10.0 (970.6)	11.0 (971.6)	12.0 (972.6)	13.0 (973.6)	14.0 (974.6)	15.0 (975.6)
Discharge, in cubic feet per second										
At McGinnis Ferry Road	450	660	919	1,250	1,740	2,500	3,580	5,130	7,110	9,680
Below Camp Creek and Caney Creek upstream from Webb Bridge Road	489	718	998	1,360	1,890	2,720	3,900	5,580	7,730	10,500
Near Alpharetta streamgage (02335700)	544	798	1,110	1,510	2,100	3,020	4,330	6,200	8,590	11,700
Below Long Indian Creek upstream from Haynes Bridge Road	566	830	1,160	1,570	1,180	3,140	4,500	6,450	8,940	12,170
Below Foe Killer Creek downstream from Georgia Highway 400	636	933	1,300	1,770	2,450	3,530	5,060	7,250	10,000	13,700
Below Hog Wallow Creek at Roswell, Georgia streamgage (02335757)	661	969	1,350	1,830	2,550	3,670	5,260	7,530	10,400	14,200
Stage, in feet above the gage datum										
Below Hog Wallow Creek at Roswell, Georgia streamgage (02335757)	4.6	5.4	6.4	7.6	9.2	11.3	13.8	16.3	19.1	22.2
Water-surface elevation, in feet above NAVD 88										
Below Hog Waller Creek at Roswell, Georgia streamgage (02335757)	926.9	927.7	928.7	929.9	931.5	933.6	936.1	938.6	941.4	944.5

Table 4. Stream stages (and water-surface elevations) at the Big Creek near Alpharetta, Georgia, streamgage (02335700), with reference to corresponding map-sheet numbers in this report.

[Values 6.0–15.0 represent stage, in feet above the gage datum. Values in parentheses (916.9–925.9) represent surface-water elevation in feet above North American Vertical Datum of 1988; —, not applicable]

Big Creek near Alpharetta										
Stage (water-surface elevation)	6.0 (966.6)	6.5 (967.1)	7.0 (967.6)	7.5 (968.1)	8.0 (968.6)	8.5 (969.1)	9.0 (969.6)	9.5 (970.1)	10.0 (970.6)	10.5 (971.1)
Sheet number	1	2	3	4	5	6	7	8	9	10
Stage (water-surface elevation)	11.0 (971.6)	11.5 (972.1)	12.0 (972.6)	12.5 (973.1)	13.0 (973.6)	13.5 (974.1)	14.0 (974.6)	14.5 (975.1)	15.0 (975.6)	—
Sheet number	11	12	13	14	15	16	17	18	19	—

Summary

A series of estimated flood-inundation maps was developed by the U.S. Geological Survey (USGS), in cooperation with the cities of Alpharetta and Roswell, Georgia, for a 12.4-mile reach of Big Creek that extends from 260 feet above the McGinnis Ferry Road bridge to the USGS streamgage at Big Creek below Hog Wallow Creek at Roswell, Georgia (02335757). These maps, available at a USGS Web portal, in conjunction with the real-time stage data from the USGS streamgage at Big Creek near Alpharetta, Georgia (02335700), and National Weather Service flood-stage forecasts, can help to guide the general public in taking individual safety precautions and can provide local officials with a tool to efficiently manage emergency flood operations and flood-mitigation efforts.

The maps were developed using the U.S. Army Corps of Engineers HEC–RAS and HEC–GeoRAS computer programs to compute water-surface profiles and delineate estimated flood-inundation areas for selected stream stages. The maps show estimated flood-inundation areas overlain on high-resolution, georeferenced, aerial photographs of the study area for 0.5-foot intervals of stream stage between 6.0 and 15.0 feet (gage datum) at the Big Creek near Alpharetta, Georgia, streamgage (02335700).

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